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ABSTRACT

The Department of Energy has a direct stake in the quality and distribution of mathematics and science education in the United States. Because the problem cannot be solved without the collaborative efforts of all key public and private parties and because the Department of Energy can make a unique contribution of facilities and human resources to the cause, a conference was convened. The year 2000 was established as the target for accomplishing the goals outlined in this document, so that the efforts will move in conjunction with those of the President and the Governors. The goals of the plan include: excellent preparation in mathematics and science for students in every grade; empowered teachers; significantly greater participation in mathematics and science education and careers for underrepresented groups; public literacy; and a competitive work force. The chairmen's recommendations and strategies for each goal are presented. The role of the Department of Energy (DOE) laboratories, DOE leadership, and federal interagency effort are discussed. The working group reports include: (1) "Teachers"; (2) "Curriculum"; (3) "Underrepresented Students"; (4) "The Math/Science Pipeline"; (5) "Inner-City and Rural Schools"; (6) "General Math/Science Literacy"; and (7) "Community and Professional Outreach." Appended are the conference agenda, staff list, bibliography, and acknowledgments. (KR)

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Math/Science Education Action Conference Report

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May 1990

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Math/Science Education Action Conference Report

U.S. Department of Energy
May 1990

The Lawrence Hall Of Science, Berkeley, California

On October 8-10, 1989, the U. S. Department of Energy, the Lawrence Hall of Science, and the Lawrence Berkeley Laboratory sponsored a Math Science Education Action Conference in Berkeley, California. The conference was co-chaired by Admiral James D. Watkins, Secretary of Energy, and Dr. Glenn T. Seaborg, Chairman of the Lawrence Hall of Science. Nearly 250 scientists, educators, business executives, and government leaders came together to develop a concrete plan of action for restructuring and revitalizing mathematics and science education. Their target was to improve education for an entire cohort of children—the Class of 2007, the children born this school year—and their governing principle was one of collaboration, both between Federal agencies, and between public and private sectors. What follows is the report of the conference co-chairmen and participants.

TABLE OF CONTENTS

CHAIRMEN'S STATEMENT

OVERARCHING PRINCIPLES 1

RECOMMENDATIONS AND STRATEGIES 6

BUILDING A DOE MODEL 12

FEDERAL INTERAGENCY EFFORT 16

WORKING GROUP REPORTS

WORKING GROUP I: *Teachers* 19

WORKING GROUP II: *Curriculum* 25

WORKING GROUP III: *Underrepresented Students* 32

WORKING GROUP IV: *The Math Science "Pipeline"* 41

WORKING GROUP V: *Inner-city and Rural Schools* 48

WORKING GROUP VI: *General Math Science Literacy* 54

WORKING GROUP VII: *Community and Professional Outreach* 60

APPENDICES

CONFERENCE AGENDA 70

STAFF LIST 73

BIBLIOGRAPHY 76

ACKNOWLEDGMENTS 80

CHAIRMEN'S STATEMENT

Dr. Glenn T. Seaborg
Chairman
Lawrence Hall of Science

James D. Watkins
Admiral, U.S. Navy (Retired)
Secretary of Energy

"We believe that strengthening mathematics and science education is not just the right course of action for the Nation – it is the only course."

OVERARCHING PRINCIPLES

OUR MOTIVE

The primary mission of the U.S. Department of Energy is to supply the Nation with the energy resources, technologies, and information needed for economic progress and national security. To fulfill that responsibility, the Secretary of Energy must be able to staff the Department with highly qualified mathematicians, scientists, engineers, and technicians. Just as important, the Secretary must be able to rely upon a scientifically and technologically informed citizenry to help chart a course for public energy policy.

On both counts, the mission of the Department is in jeopardy.

By every measure, our schools are failing to produce scientifically literate graduates. Student achievement in mathematics and science is unacceptably low, especially compared with that of our international counterparts. Too many young people—particularly female and minority students who represent a largely untapped resource—lack the preparation they need to advance to higher education and to careers in scientific and technical fields. Too few teachers receive training of the depth and currency required to deliver mathematics and science instruction in a way that sparks student interest. Public knowledge of scientific and technical subjects is alarmingly inadequate in light of the complex issues our Nation faces.

The Department of Energy has a direct stake in the quality and distribution of mathematics and science education in the Nation. We convened this Conference because the problem cannot be solved without the collaborative efforts of all key public and private parties and because the Department of Energy can make a unique contribution of facilities and human resources to the cause.

In preparing for this conference, we realized that the children born today will graduate from high school in the year 2007, the fiftieth anniversary of the launch of Sputnik, the event which began a post-war revolution in mathematics and science education in America. To reach this unique cohort of students, in addition to the millions of children already in school, we have established the year 2000 as the target for accomplishing the goals outlined in this document, so that our efforts will move in conjunction with those of the President and the Governors. We consider this the near-term time frame in which to take the actions necessary to sustain lasting change.

OUR GOALS

We endorse the following goals, to be achieved by the year 2000:

1. **Students.** American elementary and secondary students will receive excellent preparation in mathematics and science in every grade.

   Performance. American students will be the best in the world in their knowledge of mathematics and science.

   Curriculum. The Nation will have in place an integrated, interdisciplinary core curriculum for mathematics and science in pre-school through high school.

2. **Teachers.** The Nation's mathematics and science teaching professionals will attain their rightful place as full-share partners in the scientific community and will become empowered to prepare this generation of children for lives of discovery in the 21st Century.

   Enrichment. Each year 10% of the Nation's teachers will be provided with high-quality teacher enhancement programs in hands-on science.

   Partners. Scientists, engineers, and mathematicians will serve as volunteer expert education partners to bring cutting-edge science into the Nation's classrooms, in numbers equaling 10% of the teaching force.

3. **Underrepresented Groups.** Significantly greater numbers of female, minority, disabled, and disadvantaged students will complete a K-12 education program, advance to the highest levels of mathematics and science education, enter careers in mathematics and science, and complete teaching programs in these fields.

4. **Public Literacy.** Citizens will understand and derive excitement from confronting new frontiers in science, mathematics, and technology and will appreciate their potential for bettering our society and our world.

   Science Alliances. Mathematics and science community alliances including partners from government, education, and business, will be established or significantly expanded in 10% of the Nation's school districts over the next 24 months.

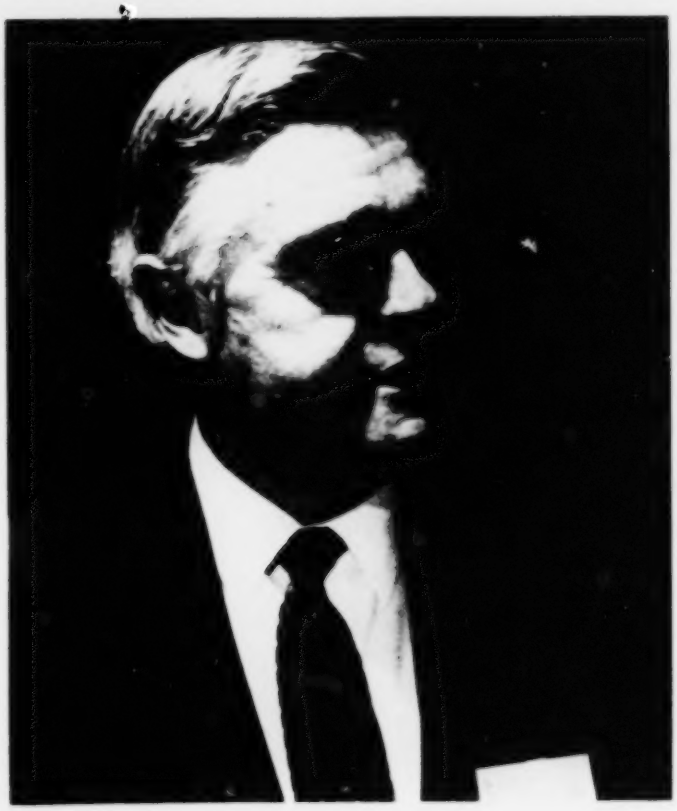
5. **Competitive Work Force.** The Nation will have a diversified work force, competent in mathematics and science and equipped to meet the technological demands of the 21st Century.

OUR STRATEGY

We believe that the Department of Energy, with its unparalleled collection of scientific laboratories, facilities, and experts, has the potential to set a highly visible and creative example of educational collaboration for the Federal Government and the private sector. The Department has excellent resources and program models that have been little known for too long. It is time to move these programs out of the shadows and in so doing, inspire other Federal agencies and the private sector to develop similar models of cooperation.

As Co-Chairmen of the Math/Science Education Action Conference, we will initiate and support a series of vigorous and immediate steps to use the Department's resources to help strengthen mathematics and science education in the Nation. Specifically, we are asking the Department's laboratories and facilities to:

- Open their doors to their surrounding schools and communities.
- Develop programs for students and teachers that will be models for the entire Federal government.
- Collaborate with the business sector, universities, school districts, other laboratories, science-technology centers, and community groups in order to improve math and science education.
- Encourage volunteerism and community service from their employees.



Secretary James D. Watkins

"Our mission is to ensure that the history books of the 21st Century will not tell of a once great nation that declined and fell because it lost its passion for science."

— Secretary Watkins

We are not suggesting that the Department of Energy can replace the schools or the State and local educational agencies as the primary providers of instruction. In carrying out model programs, the Department will respect the knowledge and leadership of those with the chief responsibility for education and will build on the many excellent Federal, State and local efforts already underway.

We will also forge linkages with other entities with a stake in mathematics and science education, including the Department of Education, the National Science Foundation (NSF), the National Aeronautics and Space Administration (NASA) and other Federal agencies, the White House, the Congress, the Governors, State legislatures, State education departments, higher education institutions, school boards, administrators, principals, teachers, scientists, science-technology centers, museums, public libraries, foundations, corporate leaders, parents, and the general public.

The next section of the Chairmen's Statement spells out our recommendations and strategies for achieving the aforementioned goals. These goals are closely aligned with the National Education Goals announced in the President's State of the Union address and were produced with an awareness of the results-oriented model for reforming education that emerged from the President's Education Summit with the Governors in Charlottesville, Virginia.

"Building a DOE Model" describes the roles of DOE National Laboratories and leadership in implementing a model of educational collaboration, and the final section sets forth a blueprint for a Federal interagency effort to improve mathematics and science education.

The goals, recommendations, and strategies in this Chairmen's Statement are not the only outcome of the Berkeley Conference. The participants, meeting in small working groups, produced an impressive array of public-private projects for revitalizing mathematics and science education that can be initiated by the beginning of next school year. These projects range from limited local commitments to broad national ones and are reported in a separate section of this document, entitled *Working Group Reports*. We consider the many creative and specific projects enumerated in *Working Group Reports* to be an indispensable amplification of the strategies outlined in this Chairmen's Statement.

We recognize that the thrust of our goals and strategies may represent a change of mission and a new way of thinking for Federal agencies and their public and private partners.

We believe, however, that strengthening mathematics and science education through collaboration is not just the right course of action for the Nation—it is the only course.

Dr. Glenn T. Seaborg

"Our Nation is at risk. Our once unchallenged preeminence in commerce, industry, science and technological innovation is being overtaken by competitors throughout the world. If an unfriendly power had attempted to impose on America the mediocre educational performance that exists today, we might well have viewed it as an act of war. As it stands, we have allowed this to happen to ourselves. We have in effect been committing an act of unthinking, unilateral educational disarmament."

Dr. Seaborg quoting from "A Nation at Risk"

CHAIRMEN'S RECOMMENDATIONS AND STRATEGIES

Conference participants proposed recommendations and strategies for achieving each of the goals listed above.

Implementing these recommendations and strategies will require action from all the partners represented at the Berkeley Conference, too many to name, and will require concerted Federal effort and leadership from the White House, the Department of Education, the National Science Foundation, the National Aeronautics and Space Administration, the Department of Energy, and other agencies in partnership with the private sector.

Secretary Watkins and Dr. Seaborg

GOAL #1: STUDENTS

By 2000, American elementary and secondary students will receive excellent preparation in mathematics and science in every grade.

- *Performance.* American students will be the best in the world in their knowledge of mathematics and science.
- *Curriculum.* The Nation will have in place an integrated, interdisciplinary core curriculum for mathematics and science, pre-school through high school.

Recommendations/Strategies:

1. We affirm the principle that every student must and can study mathematics and science every year, pre-school through high school, as a part of the core curriculum.

2. The Department of Energy (DOE), the National Science Foundation (NSF), the Department of Education, the National Aeronautics and Space Administration (NASA) and other Federal agencies will support the efforts of the President and the Governors to establish a consensus on what students need to learn in mathematics and science and by what ages they should know it.

3. We believe that this consensus must be built upon the recent work of the American Association for the Advance-

ment of Science (*Project 2061*), the National Council of Teachers of Mathematics, the National Science Teachers Association, the National Academy of Sciences, the National Academy of Engineering, the National Research Council, the Mathematical Sciences Education Board, the National Science Resources Center, and other relevant research.

4. We recommend establishing a national goal of increasing the number of students taking chemistry, physics, life sciences, and advanced mathematics courses by 10% each year between now and the year 2000.

5. We encourage attention to new concepts and curricula for inspiring "average" students to continue in the mathematics and science pipeline.

6. We believe that the study of mathematics and science can be enlivened by encouraging "hands-on" experiences both inside and outside the classroom, and that by the year 2000, all elementary and secondary school children should have these experiences available to them each year.

7. We advocate the efforts of schools, families, and the media to change student attitudes about mathematics and science by stressing the degree to which success in these subjects depends on effort, not just ability.

8. We support instructional approaches in mathematics and science that involve the family in the educational process.

9. DOE will work with NASA, the National Science Resources Center, other Federal agencies, scientific and education associations, and the business and foundation communities to develop an on-line computer data base containing information on new and innovative mathematics and science instructional approaches, materials and experiments, to which students, educators and parents will have access.

10. As a collaborative project, DOE, NSF, NASA and other entities with expertise in system integration will develop a framework that uses government research institutions and industry to update mathematics and science curriculum content, materials, and delivery systems.

11. DOE Laboratories will become involved in developing interactive educational software, educational technologies, and other advanced instructional tools that are imaginative and pedagogically sound.

12. We are concerned by the serious deterioration of mathematics and science facilities and equipment in our Nation's schools. Therefore, we commit DOE to working with appropriate Federal agencies, the National Governors' Association, the Education Commission of the States, and the Council of Chief State School Officers, to review the Federal laboratory inventory for resources that can be made available to schools and to help place them.

GOAL #2: TEACHERS

By 2000, the Nation's mathematics and science teaching professionals will attain their rightful place as full-share partners in the scientific community and will become empowered to prepare this generation of children for lives of discovery in the 21st century.

- *Enrichment.* Each year 10% of the Nation's teachers will be provided with high-quality teacher enhancement programs in hands-on science.
- *Partners.* Scientists, engineers, and mathematicians will serve as volunteer expert education partners to bring cutting-edge science into the Nation's classrooms, in numbers equalling 10% of the teaching force.

Recommendations/Strategies:

13. Working with the President's Science Advisor, DOE will propose a model for integrated Federal/private sector action to provide high-quality teacher enhancement in mathematics and science to 10% of the Nation's teachers annually, so that by the turn of the century, development programs will have touched all K-12 teachers.

This program will initially target teachers of elementary and middle school students, and expand to include greater numbers of high school teachers in ensuing years. The program will build on existing DOE, NASA, and private sector models to offer teachers a chance to participate in real world research, and will ensure that training is attentive to equity issues.

14. We endorse recent successful efforts to increase the number of highly qualified mathematicians, scientists, and engineers entering the precollege mathematics and science teaching profession by streamlining or revamping credentialing and certification.

Through its National Laboratories, DOE will work with teacher associations and State and local education agencies to develop or assist model credentialing programs to encourage persons from mathematical and scientific fields who have or are willing to secure the credentials needed to become teachers, emphasizing both skills and subject matter knowledge.

15. We encourage qualified scientists, business people, retired professionals, and others with appropriate backgrounds and skills to serve as unique cost-free teaching resources in the schools, to assist and supplement the mathematics and science teaching force, and to bring cutting-edge science into the classroom, in numbers equaling 10% of the total teaching force.

DOE will work with the Department of Education, the Office of National Service, the American Federation of Teachers, industry, higher education institutions, the elementary and secondary education community, and parents, to create a model that coordinates these volunteers and provides them with the necessary preparation to enable them to assist teachers in the most effective way, e.g., by serving as team teachers, guest lecturers, substitute teachers, or classroom para-professionals.

16. We urge Federal and other laboratories to initiate or expand creative outreach, summer and other programs to encourage young people, especially minority students, to become mathematics and science teachers.

17. DOE will expand summer research employment opportunities for teachers in its laboratories to offer them hands-on research experiences, to provide needed augmentation of their salaries, and to enable them to bring current science and technology immediately back to the classroom.

GOAL #3: REACHING THE UNDER REPRESENTED

By 2000, significantly greater numbers of female, minority, disabled, and disadvantaged students will complete a K-12 education program, advance to the highest levels of mathematics and science education, enter careers in mathematics and science, and complete teaching programs in these fields.

Recommendations/Strategies:

18. We support a national effort to increase the number of minority and female students enrolled in mathematics and science courses at all grade levels by at least 10% annually.

19. We recommend that Federal laboratories and other scientific facilities located in areas with large minority populations develop model outreach programs for providing hands-on science experiences, education, mentoring, residential academies, and other activities, on a long-term, sustained basis, to students from underrepresented groups.

20. DOE will expand its alliances with Historically Black Colleges and Universities, primarily Hispanic colleges and universities, and other minority institutions to increase the number and range of programs aimed at pre-college minority children.

21. We believe that DOE and other Federal agencies must work with women's and minority professional societies, such as, but not limited to, the National Action Council for Minorities in Engineering, the Society of Hispanic Professional Engineers, the American Indian Science and Engineering Society, and Women in Science and Engineering, to develop strategies for increasing the number of female, minority, disabled, and disadvantaged students in mathematics and science. These strategies might include developing mentor and role model relationships, spreading positive messages about mathematics and science through the media and community organizations, helping students understand the education required for scientific and technical careers, and actively promoting mathematics and science as a viable, rewarding career choice for female and minority students.

22. We encourage every Federal agency to build upon the work of the Task Force on Women, Minorities, and Handicapped in Science and Technology and to incorporate the Task Force's recommendations into their programs.

23. We encourage Federal laboratories to develop programs that use hands-on mathematics and science, mentoring, peer tutoring, and other techniques to help prevent students from dropping out.

24. We support the expansion and replication of exemplary collaborative programs for underrepresented students, such as the Mathematics, Engineering, Science Achievement (MESA) program.

25. DOE will work with NASA to stimulate minority student interest in science by emphasizing the contributions of minority scientists in space.

26. DOE will support the Mathematical Sciences Education Board in its efforts to improve national coordination of projects involving mathematics education for minorities.

27. DOE and the Lawrence Hall of Science will work with the National Action Council for Minorities in Engineering, Inc. (NACME) and the private sector to design a modern, hands-on laboratory science component for elementary students in schools in predominantly minority communities.

GOAL #4: PUBLIC MATH/ SCIENCE LITERACY

By 2000, citizens will be able to understand and derive excitement from new frontiers in mathematics, science, and technology and will appreciate their potential for bettering our society and our world.

Recommendations/Strategies:

28. As Secretary of Energy and Chairman of the Lawrence Hall of Science, we will undertake an effort with the Advertising Council of America to develop a coordinated media plan to reach the general population and the Nation's young people with the message that the mastery of mathematics and science is a fun and achievable goal and is vital for understanding the technological society of the 21st century.

29. We further encourage the adoption by all Federal agencies of NASA's Mission to Mars initiative as a rallying point around which to build exciting science education and awareness programs.

30. We recommend that Federal agencies increase their work with the education community, the mass media, science-technology centers, museums, public libraries, the private sector, parents and the public to improve mathematics, science, and technological literacy of "average" and low-achieving students, not just for the brightest students.

31. We encourage the leaders of Federal facilities to reach out to surrounding communities and provide opportunities for students, teachers, parents, and other community people to come into their facilities to participate in exciting and highly visible scientific projects designed especially for a lay audience.

32. We urge the development of a network of science and mathematics professionals from DOE and other Federal agencies and the private sector who will volunteer in their communities to promote mathematics/science and public literacy programs in and out of school.

33. We advocate a national outreach campaign to convey the message that knowledge of science is needed to understand our society and our world and to make wise public policy choices.

34. We propose that public and private agencies, institutions, and organizations build public literacy programs around events such as Earth Day and National Science and Technology Week to illustrate how science and technology can help solve environmental problems.

35. DOE will develop a minimum of 10 pilot programs that deliver intergenerational mathematics and science experiences to children and parents in an integrated fashion and in conjunction with Head Start and other early childhood programs.

GOAL #5: A COMPETITIVE WORK FORCE

By 2000, the Nation will have a diversified work force, competent in mathematics and science and equipped to meet the technological demands of the 21st century.

Recommendations/Strategies:

36. We believe that improving pre-college education, beginning at the earliest grade levels, is the only way that the United States can increase the future supply of well-trained scientists and engineers.

37. DOE will undertake a program of outreach in its laboratories to educate people in the surrounding communities, especially young people, about scientific and technical career options and the preparation required to pursue these careers.

38. We urge the Federal government and the private sector to use their scientific facilities and personnel to offer summer and academic year internships, apprenticeships, worksite programs, and other appropriate outreach activities to encourage and expose students to mathematics, science, and technology careers.

39. We encourage governmental and private agencies and institutions to remove administrative obstacles that may impede science and engineering personnel from working with students and teachers to bring current science to the future work force.

40. We believe that the Federal government should work with the business community to help strengthen relationships between the private sector and vocational and technical training institutions.

41. DOE and the Department of Labor will collaborate on a project to create a profile of future jobs, based on *Workforce 2000*, that describes the mathematics and science skills those jobs will require. This profile will be aimed at children in grades K-8 and will be disseminated to schools.

42. We encourage professional scientific and mathematical societies to help convey to students more precisely what preparation is needed for scientific and technical careers, to stress the need for a solid background in mathematics and science education in non-scientific careers, and to work to stimulate student interest in these careers.

43. We recommend that education and training institutions highlight their preparation programs for the jobs of the future, in such critical areas as waste management, environmental restoration, and alternative energy development.

BUILDING A DOE MODEL

The Role of the DOE Laboratories

The Secretary of Energy has challenged the DOE laboratories and facilities to devise detailed plans to help strengthen mathematics and science education in the schools. Many already have exciting projects underway for teachers and students. Our intent is to build upon these excellent efforts and use them to guide the rest of the Department, and eventually to offer a comprehensive model for other Federal agencies that have scientific laboratories, equipment, and expertise.

As we envision it, the DOE model would include:

- Long-term, sustained partnerships with selected urban and rural districts and communities.
- Strong collaboration with teachers, administrators, universities, the business sector and other appropriate partners at all stages.
- Volunteerism and sharing of knowledge by scientists, engineers, and other staff.
- Elimination of administrative obstacles to forging partnerships among laboratories, schools, business, and community groups.
- Building on the results of the first year of implementation, DOE will increase the number of partnership programs each year.

The model does not involve large amounts of new money. The multibillion dollar network of laboratories is already there; the people are already in place. Physics research equipment, for example, can be turned into physics education equipment.

Specifically, the National Laboratories participating in this conference have undertaken the following initiatives:

Chicago: Through Argonne National Laboratory and the Fermi National Accelerator Laboratory, DOE will work with the Department of Education, NSF, the Chicago Public Schools, and the Chicago business community to implement two national models to improve mathematics and science education and upgrade the skills of teachers in urban school districts: the Chicago Science Explorers Program and the development of a prototype for a specialized mathematics and science teacher development academy.

California Bay Area: Through the Lawrence Berkeley Laboratory, the Lawrence Livermore National Laboratory, the Sandia National Laboratories and the Stanford Linear Accelerator Center, DOE will establish an urban partnership program targeted on the Oakland Public Schools and other Bay Area schools, in cooperation with the Lawrence Hall of Science, the University of California at Berkeley, other higher education institutions, and the business community.

Pacific Northwest: Through the Pacific Northwest Laboratory, DOE will establish partnerships with the Seattle, Portland, and

Yakima Valley School Districts, in conjunction with the Pacific Science Center and the Oregon Museum of Science and Industry, to target black, Hispanic and Native American students.

Tennessee: Oak Ridge National Laboratory, Oak Ridge Associated Universities, and the school districts of Chattanooga and Roane County, Tennessee, will collaborate on educational programs responsive to the special needs of minority and disadvantaged children and their teachers. In addition, Oak Ridge National Laboratory and the University of Tennessee will collaborate on a pilot program in alternative certification and a Young Science Teachers Program.

New Mexico: The Los Alamos and Sandia National Laboratories, in conjunction with New Mexico public school systems, New Mexico teacher training institutions, and the Mathematics, Engineering, Science Achievement (MESA) Program will establish a middle school teacher enhancement program to help teachers more effectively reach the region's student population, largely Hispanic and Native American.

Intermountain West: The Idaho National Engineering Laboratory will work with rural school districts in the Intermountain West, starting with Idaho school districts, to target rural students who lack access to adequate science laboratory facilities.

New York: Through the Brookhaven National Laboratory, DOE will work with school districts in Suffolk County, New York, and with the Bronx Community College of the City University of New York to expand and replicate local community-based educational partnerships and to develop a technology training program targeting minority students.

The Role of the DOE Leadership

The Secretary of Energy will marshal resources, monitor progress in the implementation of action projects, coordinate DOE, private sector, and intergovernmental efforts, and initiate expansion of successful projects to other Federal agencies.

In addition, with the support of the White House, the Secretary of Energy will take the following actions, resulting from the Berkeley Conference, to help implement the DOE model:

National Energy Strategy. The forthcoming National Energy Strategy will include a chapter on the role of mathematics and science education in enabling the population to make better informed evaluations and public policy decisions on science and technology issues, as well as identifying options for strengthening mathematics, science, and engineering education.

Secretary of Energy Advisory Board. The Secretary will create a board of experts with a mandate to advise the Secretary on education, science, technology transfer, defense production, and energy policy, and on ways to create and strengthen private sector partnerships to implement the education initiatives in this report.

Streamlined Credentialing. The Secretary will work with the Department of Education, the Governors, State boards of education, State education departments, teacher associations, institutions of higher education, and other appropriate bodies to develop ways to streamline credentialing so that mathematics and science experts can become educational resource people or assume new careers as credentialed teachers.

Teacher Employment. As an adjunct to ongoing programs, the Secretary will expand summer employment opportunities for teachers in Federal and private sector laboratories to make teachers full-share partners in the Nation's scientific community, to provide needed augmentation of their salaries, and to upgrade their skills.

Teacher Demonstration Laboratory. DOE will establish one model teacher demonstration laboratory at a DOE National Laboratory to provide low-cost, effective, and hands-on learning experiences for teachers and students and to offer experiments that cannot be conducted in school laboratories. In subsequent years, DOE will expand the program to additional sites, until all DOE National Laboratories are involved.

Science Alliances. The Secretary will work with the Office of National Service to establish local mathematics and science community alliances or significantly expand existing alliances, in 10% of the Nation's school districts over the next 24 months. These alliances will involve DOE facilities, other government facilities, the education community, and industry and will meet with local teachers, administrators, elected officials, and representatives of science-technology centers, PTAs, churches, civic organizations, foundations, and businesses; together, they will identify local needs, set local goals, identify successful programs, adapt these programs to local conditions, and develop plans that use schools, communities, and home as places to learn mathematics and science.

Partnership Registry. The Secretary will take the lead in assembling an inventory of successful mathematics and science education partnership programs involving Federal agencies working with other public, private and community partners, to provide successful instruction to students, parents, and teachers.

Inventory of Hands-On Projects. By the start of school year 1990-91, the Secretary will have mechanisms in place for conducting an inventory of its laboratories and programs as well as those of other Federal agencies for existing hands-on science programs for students, parents, and teachers. Upon completion, this inventory will be disseminated to the White House, other Federal agencies, the Governors, State legislators, State education departments, corporate leaders, the public, and national associations representing administrators, school boards, principals, teachers, and science-technology centers. This information will be also included in an existing on-line data system to provide dial-up linkage from any location in the country.

Superconducting Super Collider. The Superconducting Super Collider (SSC) mission represents a rare opportunity for students and teachers to gain access to front-line scientific research. The Secretary will make mathematics and science education a fundamental part of the SSC project from its inception. In partnership with the State of Texas and the private sector, DOE will put in place an advanced education and communications technology to link teachers and students directly to mathematics and science research.

State Task Force. The Secretary will serve as a member of the Education Commission of the States task force on improving mathematics and science education through State actions. This task force will link States to national and Federal resources, suggest strategies and policy options to States to restructure their education system, and improve mathematics and science education.

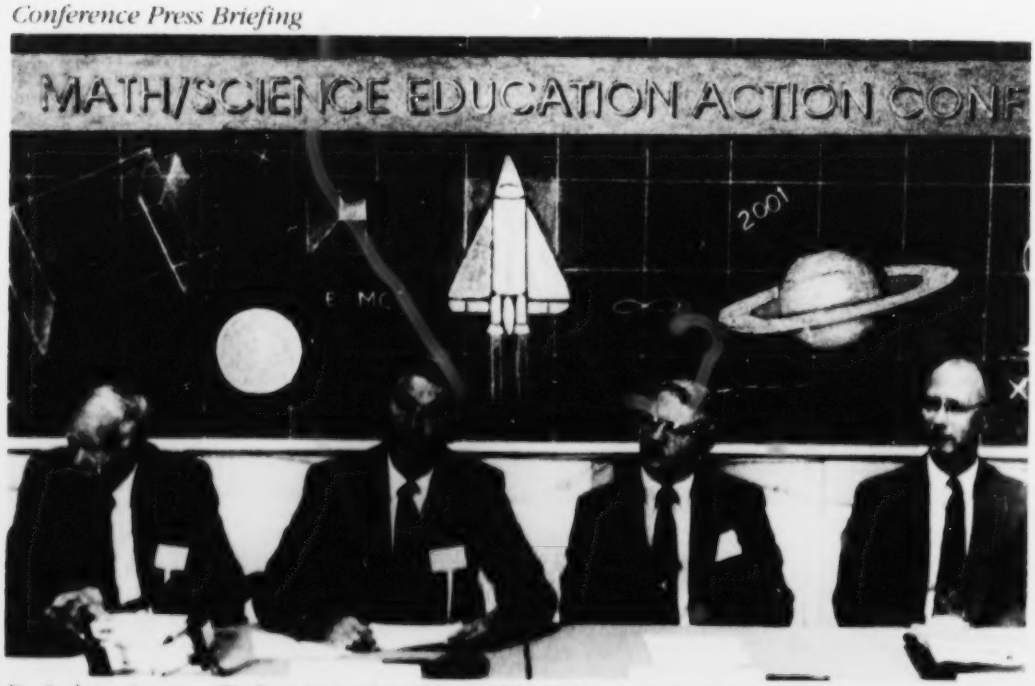
National Science Day. In cooperation with NSF, NASA, other Federal agencies, and higher education institutions, the Secretary will establish a national science project for hands-on scientific data collection that directs students nationwide to make measurements on the same day.

Instructional Materials. The Secretary will ask DOE laboratories and facilities to work in cooperation with NSF and other appropriate partners to assess the quality of available instructional materials and hands-on experiments and to create new ones where existing ones are inadequate.

Science Equipment for Schools. The Secretary will examine policies which currently affect the loan of mathematics and scientific equipment to schools and will suggest legislative changes, if necessary, to make such equipment more readily available to schools.

Monitoring and Assessment. This model is being developed with the goal of replication and will be most effective if it can be replicated. Therefore, the Secretary will establish effective assessment and monitoring procedures for evaluating progress toward meeting the Conference goals. These procedures will include a peer review component in which all significant partners in science and education will participate. The Secretary will report the results to participants in the action items.

Conference Press Briefing



Dr. Seaborg, Secretary Watkins, Vice Admiral Richard H. Truly, U.S. Navy (Retired), Administrator, National Aeronautics and Space Administration, Dr. David P. Gardner, President, University of California

FEDERAL INTERAGENCY EFFORT

Office of Science and Technology Policy

The President's Assistant for Science and Technology chairs the Federal Coordinating Council on Science, Engineering, and Technology (FCCSET), and has the responsibility for coordinating the development of a strategy to improve mathematics, science and engineering education in the Nation. We have pledged to support and assist the President's Assistant as he takes the following actions:

- Convenes an interagency committee under FCCSET, in coordination with ongoing Presidential Cabinet Council working group activities, to produce agreements among the Federal departments and agencies for major, national public and private mathematics, science and technology education partnerships, building upon the DOE model and other successful initiatives and working with the Nation's Governors and State legislators.

- Directs this interagency committee to work with all appropriate Federal agencies, including the Department of Education and the National Science Foundation, to develop a coherent interagency strategy to strengthen mathematics and science education in the Nation; and further charges the committee to ensure that the most effective use of limited Federal resources is made in support of the President's and the Governors' vision and goals for mathematics and science education and achievement.

- To the extent that consensus can be developed, takes these initiatives forward to the President and requests an Executive Order directing all appropriate Federal departments and agencies with research and development missions to add mathematics and science education as a core part of their formal missions.

Office of National Service

The work of the President's Youth Entering Service to America initiative is an essential component in the attainment of mathematics and science literacy. The Science Advisor's interagency committee will work with the White House Office of National Service to develop a plan to increase the numbers of students participating in community service projects in science, by encouraging students to tutor and mentor.

The Office of National Service will designate mathematics and science education as a priority for community service. For example, mentoring of elementary and middle school students by college and high school students is an effective way to harness community service to improve mathematics and science skills.

WORKING GROUP REPORTS

". . . No more tinkering; no more Band-Aids; no more crying about the problem. Let's get on to the solutions and let's come forth with some bold ideas."

—Dr. Gardner

Working group reports are solely the work product of group participants, and have not been prepared or edited by the Department of Energy. Many, but not all, of the suggested projects have been adopted by the Department and its laboratories.

WORKING GROUP I
TEACHERS

Purpose: To produce a set of projects that will help the Nation recruit, retain, and enhance the skills of mathematics and science teachers.

Summary

Meeting the current and future needs of all science and mathematics teachers is indeed a national challenge. Teachers in today's schools must deal with serious problems in society, while at the same time keeping up with rapid changes in their teaching fields. Partnerships with the scientific community (industry, Federal agencies, or National Laboratories) can help provide up-to-date, invigorated teachers.

The research-oriented Federal agencies, in partnerships with the teachers who educate students and the science-based industries that employ technical personnel, can contribute significantly to restoring our scientific competitiveness. The Department of Energy (DOE) laboratories, in particular, are committed to maintaining and expanding their long-term efforts with science and mathematics teachers to enhance their effectiveness in class.

Mr. Albert Shanker, President
American Federation of Teachers
Conference speaker

"Scientists keep plugging away using methods of critical thinking and intelligence to find an answer; that's the same attitude we need in our schools. I can guarantee that the best answer we can come up with is not a set of prescriptions that we're sure will work, but the next set of reasonable hypotheses to try."

—Mr. Shanker

Goals

Help assure that every K-12 student will study science and mathematics each year with an effective teacher.

Resolutions

Beginning in 1990, the Department of Energy will initiate and maintain mechanisms designed to:

- Make teachers full partners in the scientific and technical community;
- Make technical personnel from industry, federal agencies, and National Laboratories full partners in education;
- Make underrepresented minorities, women, and the handicapped full partners in both education and the technical community.

Dr. Hans Anderson, President
National Science Teachers Association
Working Group I Moderator

It will take years to have a significant impact on the overall quality of science and mathematics education. With this in mind, alliances and partnerships will be formed with the objective of reaching up to 10% of the Nation's science and mathematics teachers each year.

Actions/Projects

Specific recommendations of the Working Group on Teachers are identified briefly below.

1.1 Support broad and aggressive efforts to assist those pursuing science and mathematics teaching certification through conventional or alternative programs (with special attention to the needs of women, minorities, and the handicapped).

1.2 Support national tax policies to permit tax deductibility or credit for expenses associated with certification of those entering teaching after receiving a degree in science or mathematics.

1.3 Expand existing programs that support industry and laboratory positions for secondary teachers during the summer to supplement earnings and provide hands-on research experience.

1.4 Expand existing programs that support workshops and institutes through which teachers can enhance their classroom knowledge and laboratory skills through hands-on experiences.

1.5 Assist in efforts to establish national certification criteria for teaching science and mathematics.

1.6 Collaborate with Historically Black Colleges and other minority institutions to increase the number of students completing programs leading to careers in mathematics and science teaching.

1.7 Form school partnerships, coalitions, or alliances such as those in Chicago, Oakland, and Tennessee to expand the educational outreach efforts of federal laboratories and private industry.

Vice Admiral Richard H. Truly, U.S. Navy (Retired), Administrator, National Aeronautics and Space Administration, Conference speaker

"This is no random journey. It is a precise and exquisite movement among the heavens. Surely mathematics is the poetry of spaceflight . . . Our programs, airplanes, spaceships, astronauts, and planets can get to kids. We can book them."

—Admiral Truly

1.8 Support legislative initiatives for financial aid to retiring scientists, former teachers, and others who wish to pursue science or mathematics teaching certification while still employed in non-teaching positions.

1.9 Work with the National Science Teachers Association, the National Science Supervisors Association, and other appropriate organizations to develop national standards and criteria for required in-service and/or summer teacher development training in science or mathematics.

1.10 Expand the existing outreach efforts of federal laboratories for schools, districts, and regions including summer opportunities that contribute significantly to the over-all reimbursement of teachers.

1.11 Encourage the scientific and technical community to provide staff for direct classroom assistance (teach a course, serve as a substitute, team teach, develop instructional materials, etc.).

1.12 Improve elementary and secondary mathematics and science education by training master teachers to serve as resources for their entire school systems.

Support for these and other projects will assist national efforts to improve mathematics and science education. The result will be a larger group of students who are well-trained to pursue careers in technical fields.

This chapter was prepared and edited by:

Jon M. Veigel
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Working Group I in session

WORKING GROUP II CURRICULUM

Purpose: To produce a set of projects that will help the Nation improve mathematics and science curriculum.

Summary

Working Group II identified common ground for developing a plan of action. It agreed that consideration of curriculum and curriculum development cannot be treated in isolation from broader goals. The group's concern includes all students, not just those who will make math and science careers, and its broader goal is to make the educational system responsive to the dynamic, changing needs of math and science education for citizenship.

Curriculum development must include attention to teaching. Also, linkages between institutions of higher learning, industry, and the schools must continue to be established and expanded. The concept that all students should be studying science and mathematics as a core subject every week, every year of their K-12 education is strongly endorsed. Curricular strategies to make math and science exciting and relevant to each student's life are possible and should be a regular part of education.

A key issue that needs to be addressed for successful national curriculum reform is the inadequacy of direct communication between universities and public schools. Professionals — professors and teachers — are needed to mediate. Outstanding teachers who are able to function as mentors to less experienced teachers are also needed.

Dr. F. James Rutherford, Chief Education Officer and Director, Project 2061, *American Association for the Advancement of Science; Conference speaker*

Many studies report the need for a national set of goals in math and science that focus on upgrading standards. *Project 2061*, a report from the American Association for the Advancement of Science, *Scope, Sequence, and Coordination* from the National Science Teachers Association, and *Standards for Mathematics* from the National Council of Teachers of Mathematics are examples of the kind of studies that can be used to build a national consensus. These studies offer prescriptions for curriculum and instruction, but their prescriptions are limited by a national education system that lacks a true math and science curriculum for all students.

"We have been pretending for a long time in this country that education was a local problem. It is not. We are a nation, and our problems are national. We are going to make it as a nation or not at all and we now have clear national goals to guide our efforts."

— Dr. Rutherford

Goals

Seek a national consensus for science and mathematics K-12 curriculum reform.

Under the mantle of "National Goals with Local Implementation," the *Curriculum and Evaluation Standards* of the National Council of Teachers of Mathematics should be embraced as national objectives for mathematics programs in the 1990s. Similar standards should be adopted for science programs.

Scientists from government research institutions and industry can provide a pool of experts capable of working with teachers to develop up-to-date, scientifically valid, and age-appropriate curriculum materials.

Resolutions

- All students in America's schools should study mathematics and science each year they are in school.
- Curricula, teaching methods, and means of assessment should be designed to promote active, "hands-on" involvement of students in the learning process to help them to become problem solvers and to give them an awareness of the roles of mathematics, science, and technology in their lives and in society.

Actions/Projects

I. National Science Education Standards.

Seek a national consensus for science curriculum reform, with the following basic components:

- Science is a core subject; every K-12 student has science every week, every year;
- Science should be taught on an experiential basis at the elementary, middle, and high school levels.

Working Group II in session

Dr. Bonnie Brunkhorst, Institute for Science Education, California State University – San Bernardino and President-Elect, National Science Teachers Association; Dr. Frank Newman, President, Education Commission of the States; Dr. Luther Williams, Senior Science Advisor, National Science Foundation; Mr. Kenneth Hoffman, Executive Director, Mathematical Sciences Education Board

To accomplish this goal, we recommend:

2.1 A task force be convened to review and analyze current curriculum framework (such as the National Science Teachers Association's *Scope, Sequence, and Coordination, Project 2061*, and others) in order to establish broad goal statements for reform.

- The National Academy of Sciences or the Council of Scientific Society Presidents are possible conveners.
- Policy makers, including scientists, science educators, and teachers at all levels should be involved.

Work is to be completed by January 1, 1991.

2.2 To ensure that the educational resources required to accomplish this goal are available to schools, an "NDEA-like" [National Defense Education Act] bill to fund increased resources for experiential science should be developed and passed by Congress by January 1, 1991.

Dr. Luther Williams, Senior Science Advisor, National Science Foundation; Working Group II Co-Chairman

II. National Mathematics Education Standards.

Under the mantle of "National Goals with Local Implementation," the *Curriculum and Evaluation Standards* of the National Council of Teachers of Mathematics should be embraced as national objectives for mathematics programs in the 1990s. States and localities should be encouraged to develop curricula and local curriculum frameworks aimed at meeting these standards. A combination of Federal, State, and local resources should be used to support a battery of district-based curriculum development projects, involving teachers heavily in the development process. The number of projects should reflect varied geographic, economic, and cultural variables. The effort should be coordinated by a national organization such as the National Academy of Sciences or the Council of Scientific Society Presidents.

To accomplish this goal, we recommend:

2.3 These multi-year projects should be launched in early 1990 and be planned so that the materials and methods are made widely available as they are developed.

III. Curriculum Materials.

Scientists from government research institutions and industry can provide a pool of experts. Many are capable of working with school and university science educators to develop up-to-date, scientifically valid, and age-appropriate curriculum materials to help achieve national curriculum goals.

"Our job is to use the goal-setting process to focus attention on the kinds of reforms and structural changes that will promote tremendous innovation in math and science."

— Mr. Kolb

Mr. Charles E. M. Kolb, Deputy Under Secretary, U. S. Department of Education; Conference speaker

The curriculum development programs should have a teacher-education component that includes workshops for teachers and teacher-educators to develop and disseminate classroom approaches to teaching the material, and master teachers who will teach others in the use of these materials.
The laboratories can also provide a unique source of expertise in computer hardware and software designs that are directly applicable to the development of advanced instructional tools.

To accomplish this goal, we recommend:

2.4 The Department of Energy, using the systems integration expertise available within the Department and National Aeronautics and Space Administration laboratories, fund and immediately institute a six-month systems analysis project. This project will develop a framework within which government research institutions and industry, functioning as a technological base, will cooperate with the educational community — particularly with practicing teachers. Within this curriculum framework, development of content, materials, and delivery systems to update science and mathematics education throughout the nation can be accomplished.

2.5 Agencies support implementation of recommendations from the National Council of Teachers of Mathematics study. Specific budget proposals for Fiscal Year 1991 will include salary support for staff to work on curriculum materials development in cooperation with the educational community, and career recognition for this effort.

2.6 A national dissemination system be created to provide information about high-quality resource materials for teachers (books, manuals, laboratory materials, videos, software, satellite videos, etc.) This national network will play an important role in sharing information and enhancing awareness. PSI-net, the National Science Resources Center, educational associations and their journals, and mission agencies have communications systems to supplement the fax, phone, and computer networks in place.

2.7 For each of the above recommendations, the following parties should be involved:

- State Boards or School District governing bodies who specify curricula;
- Universities serving the area who specify entrance requirements;
- Teachers who must accept the challenge and prepare themselves to deliver quality education. (It is axiomatic that math and science teachers should be involved in every step of the process);
- Parents and students who need to support the new opportunities with enthusiasm;
- Consumers of scientific and technical human resources — Department of Energy, Department of Defense, National Aeronautics and Space Administration, industry — and the American public who must comprehend the issues of technical change;
- Professional organizations such as the National Science Teachers Association, the National Council of Teachers of Mathematics, the National Conference of State Legislatures, the American Association for the Advancement of Science, the American Chemical Society, and the American Physical Society, who have contributed significantly to curricular change and represent the range of expertise in science and mathematics education
- Other organizations, such as the National Science Foundation and the Department of Education, whose missions include direct support of and have influence in American education; and
- The National Governors' Association and the Education Commission of the States.

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WORKING GROUP III
UNDERREPRESENTED STUDENTS

Purpose: To produce a set of projects that will help the Nation encourage women, minority, and handicapped students to pursue math and science courses and careers.

Summary

The number of underrepresented minorities, females, and persons with disabilities in science and mathematics professions is so appallingly low that it is the first order of business to increase those numbers. We should immediately commit to increasing the national representation of women, underrepresented minorities, and people with disabilities receiving associate, bachelor's, and advanced degrees in science, math, engineering, and technology by 10% in 1991 and, thereafter, by an additional 10% annually.

A national mandate to increase the math and science competency of our ever-increasing minority population, and the ever-increasing numbers of female and disabled persons entering the work force, will require the coalescing of adequate resources to compensate for severe current deficits. Such resources may be partially found in reallocations of existing dollars but will most certainly require the infusion of new dollars from combined sources including Federal, State, and local agencies and the public and private sector. What is required is an education bail-out. This is totally consistent with the enormity of the measures necessary to reverse the tide in a nation at risk.

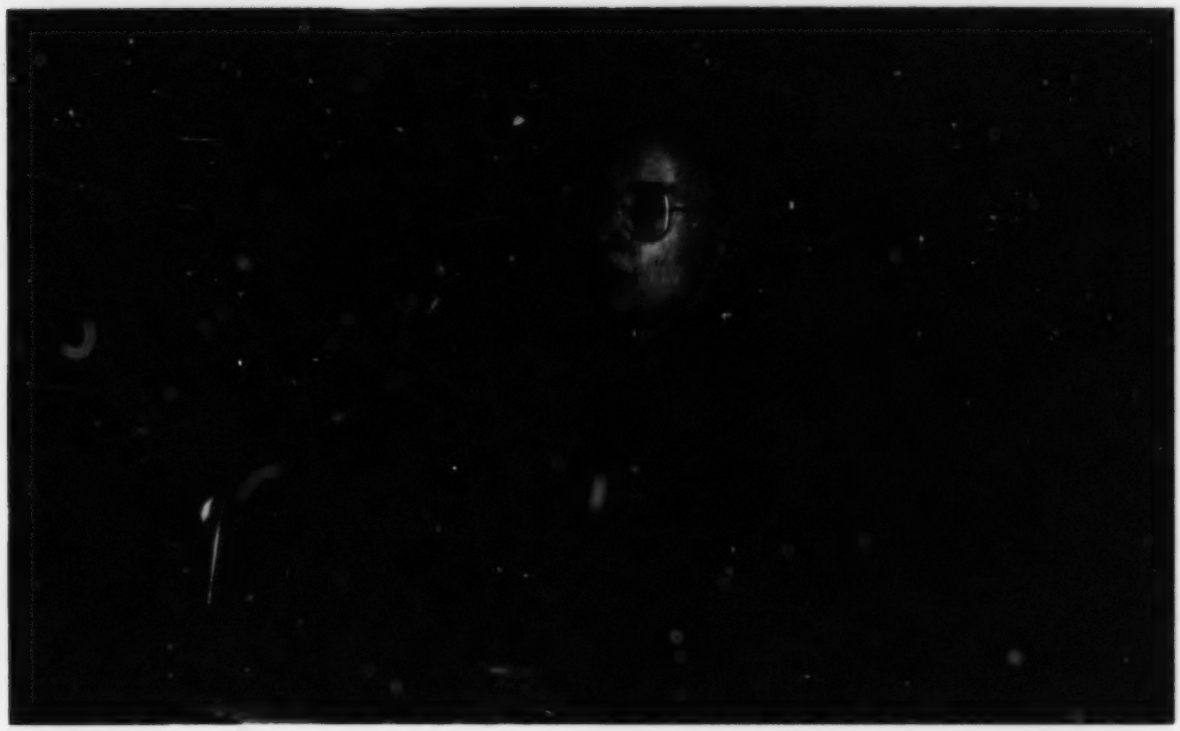
The Federal Government, in cooperation with States, localities, and the private sector, should develop specific national goals for the participation and graduation of women, underrepresented minorities, and persons with disabilities in mathematics, science, engineering, and technology from elementary school through graduate school.

In addition to developing new initiatives to meet our national goals, it is critical to take full advantage of existing, successful precollege intervention programs that exist both within and outside the Department of Energy.

A critical element in precollege science and math education is teacher development. Teacher education should be encouraged by rewarding professional growth and development in science and math education with specific emphasis on strategies that work with underrepresented minorities, females, and people with disabilities.

Specifically, the Department of Energy should work to:

- Develop funding for a series of programs to result in 320 underrepresented minority science and engineering Ph.D.'s annually by the year 2007;
- Develop math and science programs that provide hands-on experiences, introduction to the scientific method, exposure to ideas at the frontiers of science, and motivational experiences;
- Create a consortium of National Laboratories to identify, review, assess, and replicate successful precollege intervention programs;



Dr. Marcia P. Sward, Executive Director, Mathematical Association of America
Working Group III Co-Chairman

- Target 10 to 25 school districts in which to develop strong science education coalitions;
- Develop and implement advertising strategies targeting minority youth;
- Mandate a specific fraction of each department or agency's budget to promote science and mathematics education targeted at underrepresented students.

Working Group III was attended by such a large number of participants that the group was divided. We've summarized both groups' insights and recommendations, but have distinctly preserved the detail.

Goals - 3A

A national mandate to increase the math and science competency of our ever-increasing minority population, and the ever-increasing numbers of female and disabled persons entering the work force is necessary. This will require the coalescing of adequate resources to compensate for severe current deficits. Such resources may be partially found in reallocations of existing dollars but will most certainly require the infusion of new dollars from combined sources including Federal, State, and local agencies and the public and private sector.

Mr. Robert Goodwin, Executive Director, White House Initiative on Historically Black Colleges and Universities, Working Group III Moderator

What is required is an education bail-out, which is totally consistent with the enormity of the measures necessary to reverse the tide in a nation at risk.

Resolutions - 3A

- Take full advantage of the existing, successful precollege intervention programs both within and outside the Department of Energy structure.
- Encourage and support local initiatives.
- Encourage teacher education by rewarding professional growth and development in science and math education with specific emphasis on strategies that work with minorities, females, and persons with disabilities.
- Remove legislative and bureaucratic impediments to the development of creative, flexible initiatives.

Actions/Projects - 3A

3.1 The Department of Energy will create a consortium of National Laboratories with the following charge:

- Inventory the existing programs and endeavors of the National Laboratories to increase the participation of underrepresented minorities, females, and persons with disabilities;
- Determine how these efforts may be expanded through collaboration and linkages with State and local governments, the private sector, educational institutions, and local communities;

- Review and assess other successful elementary and middle school intervention programs, especially those that target underrepresented minorities, females, and people with disabilities;

- Create a generic model that can be modified to encourage replication by other agencies.

Goals - 3B

The number of underrepresented minorities, females, and persons with disabilities employed in science, mathematics, engineering, and technology is so appallingly low that it is the first order of business of the Nation to increase those numbers. We should commit to increasing the representation from these groups receiving associate, bachelor's, and advanced degrees in science, mathematics, engineering, and technology by 10% in 1991 and, thereafter, by an additional 10% annually.

Resolutions - 3B

A national goal to increase the mathematics and science competency of our ever-increasing minority population, and the ever-increasing numbers of female and disabled persons entering the work force, will require the coalescing of many resources to compensate for severe current deficits. Such resources may be partially found in:

Dr. Harlan Watson, Deputy Assistant Secretary for Water and Science and Science Advisor to the Secretary, Department of the Interior; Dr. José F. Méndez, President, Fundación Educativa Ana G. Méndez; Working Group III Co-Chairman

- Reallocations of existing dollars;
- Collaborative efforts between the Federal Government, State and local governments, and the private sector;
- Setting of national goals and executive mandates for the participation and graduation of women, underrepresented minorities, and the handicapped in mathematics, science, engineering, and technology from grade school through graduate school;
- Taking full advantage of existing, successful precollege and college intervention programs that exist both within and outside the Department of Energy.

However, a strong step forward to bridge the gap will require the infusion of new dollars from combined sources, as well as tenacity and commitment from all responsible parties.

Working Group 3B participants felt strongly about moving forward now to affect the number of graduates in the 1990's. Their commitment to this effort is shown in the following list of projects and actions for which the organizations they represent are taking the lead responsibility. This listing also serves to illustrate the range of possibilities for actions which can be, and in many cases are being, undertaken by governmental agencies and private educational and scientific groups, often in collaboration with one another.

Actions/Projects - 3B

3.2 An Executive Order to be proposed to the President.

The National Action Council for Minorities in Engineering, Inc. (NACME) is drafting an Executive Order, to be proposed to the President of the United States, which will include a statement directing all agencies to participate in the mathematics, science, engineering, and technology education of underrepresented groups and establish a mechanism for coordinating activities to meet specific strategic objectives and goals.

3.3 Review of Federal agency procurement policies.

The National Aeronautics and Space Administration (NASA) will initiate a review of Federal procurement policies toward the objective of encouraging direct government contractor involvement in reaching the goals enumerated in the Preamble of the "Chairmen's Statement."

3.4 Initiatives to attract Native American students.

The Department of Interior (DOD and Department of Energy (DOE) will jointly expand the current DOE initiatives in Idaho and New Mexico to attract Native American students to mathematics, science, and engineering disciplines.

3.5 Replication of intervention programs.

The Mathematical Association of America (MAA) will undertake a program designed to encourage replication of successful secondary school and collegiate intervention programs in mathematics in every state in the Union.

3.6 Model programs in mathematics, engineering, and science.

Mathematics, Engineering, Science Achievements, Inc. (MESA) will continue to work toward enhancing and establishing model programs that are widely

Mr. Bill Kurtis, Producer, The New Explorers; Dr. George Campbell, Jr., President, National Action Council for Minorities in Engineering

replicable. This work is being conducted in collaboration with DOE National Laboratories, State legislatures and State departments of education, the private sector, elementary, secondary and post-secondary schools, community-based organizations, students, and parents.

3.7 Coordination of projects for minorities and mathematics.

Following its May 1990 convocation at the National Academy of Sciences, "Making Mathematics Work for Minorities," the Mathematical Sciences Education Board (MSEB) will undertake to provide national coordination of projects aimed at improving the mathematical education of minorities.

3.8 Hands-on laboratory curriculum for elementary schools.

NACME will work with DOE, the New York City school system, and the private sector to design a model hands-on modern laboratory science component of the curriculum for elementary school students at schools in predominantly minority-populated communities.

3.9 Summer science camp for elementary students.

NACME will work with DOE, the private sector, and teachers to develop a model summer science camp aimed at at-risk elementary school students.

3.10 Video program to encourage African-American students.

The American Association of Blacks in Energy (AABE) will use existing resources with the National Technical Association's member cities to use AABE's Video Presentation Program (PEPP) to encourage young African-American students to focus their studies and consider career options in the sciences, mathematics, and engineering.

3.11 National Scholars Program.

NASA will take the lead in coordinating the newly emerging National Scholars Program with DOE, NSF, and NACME. The program will incorporate existing targeted educational programs (government and private sector) and developing new programs that contribute to a national goal of quadrupling the number (to 320) of underrepresented minorities receiving a Ph.D. in science or engineering by the year 2007. The net effect of the goal will be to substantially increase numbers throughout the entire educational pipeline.

3.12 One Plus Two Plus Four Program.

The DOE, NASA, NSF, and NACME will take the lead in coordinating existing programs to track students from high school, community colleges, and universities to ensure that they get exposure to higher education. Efforts will focus on academic and job experience to stimulate their interest in pursuing graduate degrees.

3.13 Public information programs.

- Many of the organizations represented in the Working Group will seek to develop alliances with the media to eliminate stereotyping and increase the presence of positive role models in mathematics, science, and engineering.
- NACME will produce public service advertisements for electronic media likely to reach minority youth, e.g., "Engineering Minutes" akin to "Big Apple Minutes" in New York. It will also work with the media to produce a music video on a science and engineering theme.
- MESA will continue to work regionally and nationally with other precollege initiatives to create a high level of awareness in mathematics and science, to form alliances, and to coordinate program efforts so as to avoid duplication of acitvities.

3.14 Recruiting campaign.

DOE will take the lead in exploring a campaign to recruit today's youth into science, mathematics, and engineering similar to the campaigns conducted by the Department of Defense.

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WORKING GROUP IV
THE MATH/SCIENCE "PIPELINE"

Purpose: To produce a set of projects that will help the Nation inspire the great majority of America's "average" students to continue in the math/science pipeline.

Summary

To meet the needs of the Nation's skilled workforce-of-the-future, and to ensure that America's children are prepared to participate fully in a democratic society, we resolve to maintain all students in the science, mathematics, and technology pipeline as long as possible, keeping their options open to achievement and careers in science, mathematics, and technology.

To broaden the talent pool feeding the pipeline, we must ensure that all students regard themselves as capable of achieving in science and mathematics. Two specific proposals to DOE to achieve this goal, for example, are the Students Watching Over Our Planet Earth (SWOOPE) and OPTIONS projects. Both projects will make science relevant to students through hands-on experience. In the SWOOPE project, students will use measurement instruments from Discovery Kits produced at a DOE laboratory to take measurements of the environment. The data they collect will contribute to a national database. In the OPTIONS project, students and teachers from middle schools will participate with scientists at a DOE laboratory in workshops that recreate the process scientists go through to design, conduct, and report research projects. Both proposals use real-world applications of science to motivate students and build their confidence in their ability to do mathematics and science.

Mr. Bill Honig, Superintendent for Public Instruction and Director of Education, State of California Conference speaker

"The answers lie right at the center of what we do day by day: building on the experience of success out there and doing something about it."

— Mr. Honig

At all levels, community members, scientists, teachers, and others are needed to mentor, tutor, and inspire those at a less advanced level of development or achievement. A system of awards and rewards needs to be established for individuals who volunteer time to this effort. This includes adding volunteerism to the award system at DOE laboratories.

Science must be made attractive to all students through role models, mentors, and the media. Methods proposed to achieve this positive image include providing more science awards for students and emphasizing the human side of science. Establishing a National Science Club is one action proposed to provide students with more mentors and role models. The Chicago Explorers Project would reach young students, introducing them to science and scientists. Another project is the Sports Promotion for Science. National Football League (NFL) players would publicize programs at National Laboratories for teachers and students to participate in science and these announcements would be televised during football games. In addition, the private sector would be urged to become committed to the science education effort by supporting science centers through traveling exhibits and science camps.

Quality teachers are essential to ensure that students stay in the science and mathematics pipeline. Teachers must be empowered with training, resources, rewards, and flexibility to achieve quality science, mathematics, and technology education. One proposed project to make DOE laboratory resources available and to train teachers is the Equipment Loan and Teacher Training Program through which teachers are provided with instructional strategies, better equipment, and opportunities to increase their scientific knowledge. The proposed Chicago Science Teachers Academy is another potentially powerful way to reach and support teachers. Finally, teachers need respect and full-share membership in the scientific community. To help achieve this goal, laboratories could adopt school teachers or school systems, for example, a high school and its lower-grade feeder schools.

In science and mathematics education, we face a serious crisis. We must act immediately at national and local levels to maintain all students in the science, mathematics, and technology pipeline as long as possible.

Goals

Provide an education that enables all children to participate in the excitement and challenge of science, mathematics, and technology. Attaining this goal will increase in some measure the supply of scientists and engineers, but more importantly, will help students retain career options, understand their world, and become full members of a democratic society.

Resolutions

Take specific actions, including integrating science and mathematics into the total curriculum by 1995, with the overall objectives listed below.

- Maintain all students in the science/mathematics/ technology pipeline as long as possible.
- Establish the understanding that all students can do science, by raising both expectations and performance for both students and teachers.
- Inspire greater volunteerism among scientists, teachers, and students at all levels.
- Develop positive depictions of science and scientists in all communities.
- Provide the stable support required to ensure a quality science, mathematics, and technology education for all.

Actions/Projects

4.1 Require science and mathematics for every student every year (K-12). Integrate science and mathematics into the total curriculum by 1995.

- Make science mathematics technology relevant with hands-on opportunities.

  Students Watching Over Our Planet Earth (SWOOPE), a Los Alamos National Laboratory initiative, would enable elementary and middle school students to take measurements of the environment with reliable instruments (which would be included in a Discovery Kit with background information) and use the data they collect to contribute to a national database. Each Discovery Kit focuses on one concept of national concern having to do with the environment or energy (e.g., pollutants in water, UV radiation from ozone loss, radon in homes). The data gathered by the students should be of use to other agencies (e.g., Environmental Protection Agency, NASA, universities).

- Keep students' science mathematics technology options open as long as possible.

  OPTIONS, a Pacific Northwest Laboratory initiative, will involve middle school students and their teachers participating with scientists in a series of workshops that recreate the process a scientist might go through to design, conduct, and report on a research project. This program uses both hands-on experience and mentors to show students options they have for careers in science. Scientists also provide the teachers with options for teaching science. The initial target audience involves middle schools with high minority populations in Washington State. The program model can be applied wherever scientists and engineers are available to students and teachers.

4.2 Empower teachers with resources, rewards, and flexibility to achieve quality science mathematics technology instruction.

- Provide opportunities for training and hands-on skill development.

- Support technology education teachers (industrial and vocational arts).

  Pairs of teachers from the same secondary school, including one teacher in mathematics science and one technology education or vocational teacher, should be invited for summer study at DOE National Laboratories. Following the laboratory experience, the teachers should be assisted in establishing networks to further develop the outcome of the laboratory experience and to expand coverage of the DOE teacher development to other teachers throughout the school year.

Mrs. Barbara R. Morgan, Teacher in Space Designee, National Aeronautics and Space Administration Conference speaker

- Open laboratory resources (technical and human) to meet the needs of teachers.

The Equipment Loan and Teacher Training Program, a Los Alamos National Laboratory-initiative, would:
1) provide educational scientific equipment and instructions to teachers;
2) conduct workshops to train teachers at DOE laboratories; and
3) offer laboratory consultants for trouble shooting. A pilot program would be tested in New Mexico and then replicated in other states.

- Respond to human needs of teachers (respect and membership in the scientific community).
- Adopt a school, a teacher, or a school system.
- Set up an information network or clearing house.
- Take advantage of current educational research and nationally acclaimed models for math science education to help teachers reach the underrepresented.

4.3 Develop positive depictions of science and scientists in all communities.

- Involve the media in science education.

  The proposed Sports Promotion for Science is an example of a national media effort to improve the image of science and the scientists. In the summer, NFL football players would join teachers at laboratories to participate in science and produce television commercials on a science education theme. In the Fall, these commercials would be played during football games.

- Establish awards for science teachers and students.
- Emphasize the human side of science.

Dr. William R. Wiley, Director, Battelle/Pacific Northwest Laboratory; Working Group IV Moderator

4.4 Provide mentors/role models to local schools.

- Provide incentives for upper-grade students to present science to lower grades (e.g., UC-Berkeley Human Biology model).
- Recruit scientists in professional science associations to help students.
- Apply team approaches to problem solving.
- Establish a National Science Club.

  The National Science Club would give students and teachers a way to communicate with scientists and professionals throughout the nation. A newsletter would enable students and teachers to send questions about science to the club. Club headquarters would screen the letters and send them on to the scientists

who would answer the question. The club also could produce a nationally syndicated newspaper column with the questions and answers.

4.5 Enlist private sector commitment to supplement classroom opportunities.

- Make science more relevant to broad current issues.
- Establish science camps for students.
- Provide "Saturday Morning Science" and "Wednesday Night Explorers."
- Establish a national science project for hands-on scientific data collection with students nationwide making measurements on the same day. (See SWOOPE).
- Support museums and traveling exhibits and curriculum follow-up for teachers (e.g., Exxon Telecommunications Network at science and technology centers).
- Support Boy and Girl Scouts, 4H Clubs, Agricultural Extension Services.
- Provide field trips to both industry and DOE laboratory sites to show everyday jobs that require math and science.
- Support career days and career counseling for students.

4.6 Develop a system of awards and rewards and reduce institutional barriers to community service, volunteerism, and sharing of resources.

- Add volunteerism to the award system at laboratories.
- Reward teachers for inspiring creativity, as well as teaching curriculum.

4.7 Develop consortia to seed efforts and to support and replicate successful interventions.

4.8 Provide criteria and evaluation mechanisms for efforts.

4.9 Support national initiatives:

- National Science Project;
- National Science Club;
- National Computer Database and Information Network for Teachers;
- National science camps;
- National media campaign;
- National partnership of DOE Laboratories with States and local schools;
- National volunteer effort for science education;
- National initiative to reduce institutional constraints on or burdens to improving science education; and
- National programs based on the DOE Teacher Research Associates (TRAC) program and Chicago projects aimed at improving science education in inner-city schools.

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WORKING GROUP V
INNER-CITY AND RURAL SCHOOLS

"When you're an active scientist, you're a teacher."

—Dr. Lederman

"If you don't know something, you cannot teach it, and we have that happening in our schools every day."

—Ms. Monteagudo

Purpose: To produce a set of projects that will help the Nation revitalize mathematics and science education in inner-city and rural schools.

Summary

Working Group V of the DOE Math Science Education Action Conference found that the task of revitalizing math and science education in inner-city schools requires no less than a national effort and commitment. The group found that it is essential for the Nation to make this effort and commitment and it pointed the way by articulating a national goal and a set of four resolutions to reach that goal. Specific actions and projects are detailed to implement each of the resolutions for the next 12 months, the next five years, and for the high school graduating class of the year 2007.

Goals

The goal is to have the mathematics and science achievement of all our young people be nothing less than the best in the world.

To that end, we must have as a national goal, to graduate from high school, particu-

Ms. Lourdes Monteagudo, Deputy Mayor for Education, City of Chicago; Dr. Leon Lederman, Director Emeritus, Fermi National Accelerator Laboratory, Governor's Science Advisor, State of Illinois, Professor of Physics, University of Chicago

larly in inner-city and rural settings, students whose mathematics and science achievements are at a level that will enable them, without remediation, to: become part of a highly competitive and productive American work force; and or enter college prepared to successfully pursue math and science fields as options.

Resolutions

The goals will be achieved by means of the following four resolutions:

- Dramatically change the climate for learning and raise the expectations for all students regardless of socioeconomic background or race;
- Empower educators to be innovative, effective, state-of-the-art teachers of math and science;
- Replicate exemplary projects that have made a significant difference in the math and science achievement of students;
- Mobilize community resources, including those of the Federal Government, business, community-based organizations, and parents.

Actions/Projects

Over the next 12 months:

5.1 Expose 10% of inner-city and rural teachers of math and science to relevant training for their setting so that they can understand and communicate their subject to inner-city and rural students, being fully cognizant of the cross-cultural elements in the teaching process.

5.2 Offer an optional 10th and 11th month of employment and education for teachers, using existing facilities, and begin summer programs for students concentrating on math and science. The NSF summer programs of the early 1960's could be used as a guide, or the Chicago Plan could be a model for the implementation.

Mr. W. J. Price, President, Chevron U.S.A. Inc. Conference speaker

5.3 Identify and replicate programs that will assist schools in the implementation of core curricula.

In the first six months:

5.4 The Secretary of Energy calls upon the National Laboratories, in collaboration with local school districts, business, and community-based organizations, to develop a list of successful local programs for support and expansion. Examples may include:

- Project LESSON, Project HOPES, Lawrence Livermore
- Project STRETCH, Oakland Unified School District, LLNL, Sandia Labs;
- Project ACCESS, Lawrence Hall of Science;
- The Chicago Plan, Fermilab;
- DOE Teacher Research Associates, all labs;
- DOE High School Honors, all labs.

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5.5 The Secretary of Education calls for the National Diffusion Network to identify successful projects for expansion and replication in collaboration with relevant entities such as the Education Commission of the States, NSF, etc. Examples may include:

- MESA;
- Explorer Series;
- Junior Academies of Science;
- Science Olympiad;
- Science Symposium by the Department of Defense.

In the next six months:

5.6 Both the Secretary of Energy and the Secretary of Education use the RFP process to select projects for support and collaborative planning efforts within local school districts, in cooperation with business and industry in the area, retirees, armed forces bases, science museums and any other agencies that can contribute time and talent to math and science programs in the school districts.

Projects will be supported by the combined resources of all relevant players, and will serve as models for expansion and duplication in other school districts. These will be identified as core programs.

5.7 Establish local coordinating councils to define needs and to identify and develop mechanisms to obtain appropriate resources external to the school system to assist in meeting the goals — viz., tutors, mentors, hands-on activities, etc.

5.8 Determine the number of students and teachers being reached. (Establish a baseline).

Over the next five years:

5.9 Expose all inner-city and rural science and math teachers to appropriate teacher training enhancements, the latest proven curricula developments, and teaching technology to improve their comfort and confidence in the subject matter.

5.10 Monitor the effectiveness of the training programs and carry out follow-up sessions with teachers who attended the early phases of the program.

5.11 Provide a clean, light, and attractive learning environment in the inner-city and rural schools by the reconstruction or replacement of uninhabitable buildings. Provide support for new buildings, equipment paraprofessionals, and other aids that free teachers to teach.

5.12 Establish a national education system that works on a 12 month basis, with students attending for 10 months and teachers being employed for 11 months. The national educational system must express the national concern and its success will be measured by the success of the students.

5.13 Continually duplicate successful core programs and other successful program models in all inner-city and rural schools. Duplication shall involve:

- Technical assistance for implementation in other school districts;
- Multiple assessments to determine the success of the programs;
- Identification of other successful programs;
- Capacity building to bring other programs into core programs;
- An ongoing list of other promising collaborations.

5.14 Reach 50% of all students and teachers in every local school district with some element of the program.

For the class of 2007:

5.15 Establish continuous refresher training for science and mathematics teachers, routinely exchange information on successful programs, and, interact with the larger community of parents, citizens, and customers of the school system — i.e., industry, colleges, universities, and the political world.

5.16 Have in place a year-round school system which is the best in the world. The products of the system are devoted to a lifetime of learning.

5.17 Establish nationwide implementation of successful programs in all inner city and rural school districts.

5.18 Every single student is touched by external resources.

Possible partners for each of the collaborative projects include:

- Universities, institutions of higher learning;
- Community colleges;
- Businesses;
- Federally supported R&D institutions;
- Individuals (parents, teachers, administrators, and others with specific expertise);
- Health facilities;
- Interactive science education centers (museums, zoos, planetariums, etc.)
- Professional organizations;
- Volunteer social services;
- Government at all levels.

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Working Group V in session in the Chemistry Classroom, Lawrence Hall of Science

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WORKING GROUP VI
GENERAL MATH/SCIENCE LITERACY

"The problems will not find their solutions in the absence of an informed, scientifically literate society, one that can also draw on an abundance of scientific and mathematical talent."

—Dr. Gardner

Dr. David P. Gardner, President, University of California, Conference speaker

Purpose: To produce a set of projects that will help the Nation raise the level of general math/science literacy.

Summary

Math and science literacy must be expanded to increase math/science/technology proficiency. There are a large number of Americans who are unable to participate in any meaningful way in a debate on issues involving science and technology. Further, the Nation's schools are not fully preparing students for math/science/technology literacy. The importance of a literate citizenry in this country led Working Group VI to the realization that solutions may require Presidential leadership, the involvement of every means to reach Americans of all ages, and special attention to reaching parents and families.

A large number of actors will be required and our ideas for action focused on partnerships. There is a potential role for every literate American and for every American institution. Ideas for local action were many but national concepts became the focus of the discussion and are reflected in our many recommendations for action.

The frontiers of science and technology hold great promise for the American public and will have a clear impact on the quality of our lives. These frontiers — space, environment, biotechnology, and others — have the potential to capture Americans' imagination and, if done properly, to raise their math/science/technology literacy. A comprehensive national approach is outlined in the following report.

The goals of the group can be summarized as follows: instill in youths and adults across the Nation the excitement and promise in research, development, and application of math/science/technology frontiers.

Recommendations were developed and recast in the form of resolutions which

helped to formulate and target plans of action. The resolutions focus on three major needs:

- Educating the American public on the need to improve math/science/technology literacy;
- Making math/science/technology literacy a parent's responsibility and a family activity;
- Ensuring that every precollege student in the Nation has access to math/science/technology frontiers.

A number of proposed actions/programs emerged from the Working Group that will allow the Nation to meet a goal of scientific literacy:

- President Bush should bring math/science/technology literacy to the public attention and give it priority in his Administration;
- The media should be encouraged to improve their audiences' math/science/technology literacy;
- Technology should be used to reach educational institutions, such as schools and museums, to make students participants in frontier science initiatives and events.

Goals

Instill in youth and adults the excitement and promise of research and development in new math/science/technology frontiers.

Encourage the media to educate the American public on the need to improve math/science/technology literacy.

Dr. Joseph Ladish, Director, University Relations and Science Education, Los Alamos National Laboratory; Dr. Walter Massey, Vice President for Research and for Argonne National Laboratory, University of Chicago

"If each and every teacher in the Nation had an opportunity to be part of a research experience much like the teachers who have visited Lawrence Berkeley Laboratory, this would lead to a great deal of new energy in science education when teachers went back to school in the fall."

—Dr. Shank

Dr. Charles V. Shank, Director, Lawrence Berkeley Laboratory, Conference speaker

Develop educational activities in the field of math/science/technology for families to assist their children and reinforce what is being taught in the classroom.

Create a network of existing math/science/technology resources and manpower in both the public and private sectors to assist in improving math/science/technology literacy.

Resolutions/Actions/Projects

We are resolved to:

6.1 Recommend to the President that, working through his Science Advisor, he establish a senior-level, interagency coordinating group for Math/Science/Technology Education.

6.2 Recommend to the President that he identify the improvement of math/science/technology literacy as a national goal in his 1990 State of the Union message and commit to a near-term, follow-on event. For example, the Secretary of Energy and the Administrator of NASA could encourage the White House to coordinate with the various science mission agencies the development of specific math/science/technology education programs that Federal laboratories would implement beginning in April 1990 on National Science and Technology Week.

6.3 Recommend to the President that he ask all Federal agencies to examine their contributions and programs for math/science/technology education.

6.4 Encourage the development of a nationwide, technologically viable, multi-way communications network among all school districts and museums.

- Expand the Administration's National Supercomputer Highway Initiative to include schools, libraries, and museums.
- Develop an interactive central communications artery for progressive development of educational programming and promotion of nationwide, interactive educational initiatives. This will create a community-accessible and Federal agency-accessible unified educational network.

6.5 Encourage the employment of technology in the classroom.

- Develop satellite down-links, interactive video discs, artificial intelligence applications, computer-based instruction, and other similar items.
- Develop dissemination of and access to materials on environmental and health issues along with science math technology through service organizations with national coverage (e.g., PTAs), and the establishment of a center to provide coherence of materials, a national network of speakers, and a list of resources, persons, and organizations.

6.6 Encourage leaders of university, corporate, and government institutions to initiate media campaigns which accentuate the importance of math science technology to the general public.

- Develop materials in close collaboration with top scientists, engineers, and media people for major use in media.
- Open scientific and technological facilities, including governmental and corporate laboratories, to the public on a regular and predictable schedule.

6.7 Implement programs across the Nation to make more effective use of scientific and technological events for science literacy purposes.

- Create a major national education program centered around the launch of the Hubble Space Telescope.
- Develop programs and activities for all schools that involve: student participation, the media, local community resources, and parents. These would correspond to national math science technology literacy events endorsed by the President of the United States, such as National Science and Technology Week.
- Develop programs that allow a major segment of the entire student population to participate in hands-on science projects during National Science and Technology Week and the commemoration of Earth Day.

6.8 Recommend greater availability of media presentations to raise the visibility of positive things happening in math science technology education.

- Make better use of the entertainment industry, for example, linking sports with science or using cartoons.
- Invite media personalities to strategy meetings with scientists and educators for the development of programs.

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Dr. Roland Otto: Working Group VI

WORKING GROUP VII COMMUNITY AND PROFESSIONAL OUTREACH

"Professionals at the forefront of science, mathematics, engineering, and technology should become personally involved in enhancing public interest in and understanding of science and mathematics."

Purpose: To produce a set of projects that will help the Nation institute community involvement and professional outreach in attaining national science and mathematics literacy.

Dr. Frederick S. Humphries, President, Florida A&M University, Conference speaker

Summary

By calling for an active volunteer effort, national leaders in government, industry, science, mathematics, and education can promote a scientifically literate citizenry in the years ahead. Professionals at the forefront of science, mathematics, engineering, and technology should become personally involved in enhancing public interest in and understanding of science and mathematics. Scientists and mathematicians can significantly impact a student's motivation to study math and science and can encourage the support and interest of the family. Educators can be revitalized and can update their knowledge while transferring their teaching skills to science, mathematics, and technology professionals.

Working Group 7A recommended three measurable goals for action during the next year:

- Increase the number of professionals from DOE facilities who participate in science and mathematics education initiatives and alliances in their local communities in the next six months to a year.
- Promote and facilitate the formation of new alliances among other government agencies and private institutions. During the next 12 months, a task force should be convened to serve as a vehicle for identifying and reviewing available alliances. This task force in turn can then set a realistic goal as to the number of alliances that can be formed.
- Develop intergenerational programs that deliver science and mathematics experiences to early childhood programs, such as "ScienceStart."

Working Group 7B recommended the following steps, with the objective of affecting 10% of the Nation's school districts in the first year:

- Develop a network or a community alliance of science and mathematics professionals from DOE, other government agencies, businesses, professional associations, and existing coalitions who are interested in and capable of working with schools, teachers, and students.
- Through locally held meetings and other activities, identify needs of schools and communities and determine mechanisms for addressing these needs and reaching out to teachers and students.
- Stimulate and reinforce community service by tapping into and building on successful programs.

Goals - 7A

Increase the number of professionals from DOE facilities who participate in science and mathematics education initiatives and alliances in their local communities.

Promote and encourage the formation of new alliances among other government agencies and private institutions.

Develop intergenerational programs that deliver science experiences to early childhood programs.

Actions/Projects - 7A

7.1 Increase activity of DOE laboratories and existing alliances in the next six months to a year.

- Every DOE facility will make known to the school districts in its respective geographical region its willingness to provide resources for the benefit of students at all grade levels.
- Each DOE laboratory will assign a specific individual to be the contact for the outreach program and to coordinate the laboratory's activities with other interested groups (existing alliances) with a goal of increasing participation a minimum of 10% by National Science and Technology Week, April 1990.

7.2 Increase the number of science and math alliances within the next 12 months.

Mr. C. Gregg Petersmeyer, Deputy Assistant to the President, Director, Office of National Service, The White House; Working Group VII Co-Chairman

- Recommend that each DOE facility develop one new alliance in cooperation with local schools/schools districts. These alliances will include local industry/business/university partners.
- These precollege alliances will be in place by the April 1990 National Science and Technology Week (NSTW) program and be locally identified as part of NSTW activities.
- At the end of 12 months, these alliances will have formulated a program plan which will include identification of new alliance partners or groups which can form their own local alliances.
- Recommend that DOE establish the 1990 NSTW program as one that focuses on the need for science and mathematics literacy and programmatic development in the schools and the community, and also recognize existing and developing alliances as effective agents of change.
- Recommend that other U.S. agencies involve themselves in alliance development activities (e.g., the U.S. Department of Agriculture exists in every county in the country) as part of its general support of local schools.
- To be effective, local alliances need to have the active participation of:
  - K-12 education districts;
  - Local private industries;
  - Universities;
  - DOE laboratories;
  - Media;
  - Entertainment professionals;
  - Parents;
  - Elected officials; and
  - Professional science and engineering organizations.

7.3 Initiate a program to be named "ScienceStart: Back to our Future" to deliver intergenerational math and science experiences to early childhood students. The rationale for this recommendation:

- Few if any programs begin science and mathematics experiences at the pre-elementary level; this time has been identified as a critical age.
- HeadStart and similar early childhood programs involve many of our targeted mathematics and science student populations, e.g., minorities, at-risk youth. These programs involve parents, who are seen as a key to enhancing education.
- The intergenerational teaching approach will provide older students opportunities for experiencing the teaching process, and potentially increase the number of candidates for the teaching profession.
- Resources need to be targeted at building experiences for children born this year and continue building as they progress through the system. This will enhance students starting education at the same level. The programs will remain in place for the next generation of students.

The Working Group therefore recommends specifically the following:

- To develop a minimum of 10 pilot programs through National Laboratories—education alliances.
- Each program will present intergenerational mathematics and science experiences to pre-school children, e.g., in HeadStart Programs.
- Train high school students, active and retired laboratory personnel (scientists, engineers, technicians) to participate with teachers who will form teams to present science and mathematics experiences.
- Evaluate the pilot programs at the end of one year and prepare to initiate a program that will incorporate the successes learned

Dr. Hector Tinnirian, Staff Scientist, Science Education Center, Lawrence Livermore Laboratory
Working Group VII Co-Chairman

and that can be disseminated more widely through the alliances described above.

This group recognized that institutional changes would greatly facilitate the implementation and effectiveness of these proposed activities.

7.4 DOE facilities need to recognize the professional participation of their technical personnel in community activities. Recognition could be part of their performance evaluation and through the provision of funds that will defer the costs of their activities.

7.5 Setting up a national umbrella to serve as a mechanism for monitoring, evaluating, and aiding the above programs. This umbrella will also serve as a dissemination network to help other technical institutions become part of the outreach efforts, and to help educational institutions learn what is available in their communities.

Goals - 7B

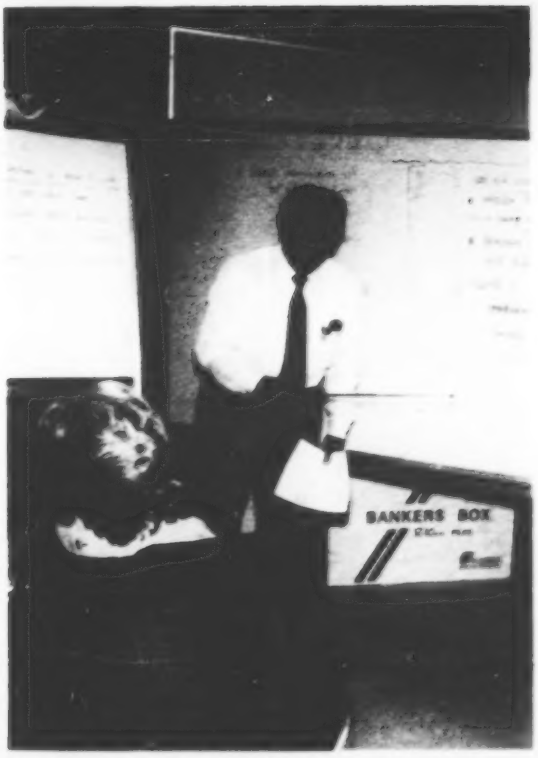
Given that science and mathematics literacy should be the concern of every citizen:

- Facilitate the involvement of science and mathematics professionals and community members with schools and families. This will increase interest in science and mathematics, and improve motivation to study these subjects, and give confidence to students and teachers in their ability to "do science and mathematics".
- Recognize the value of and reward volunteer participation.
- Identify the needs of schools and families by direct involvement of the mathematic and scientific community with teachers, schools, and the community-at-large.
- Determine what works and multiply these efforts.

Resolutions - 7B

Affect the Nation's schools over the next year by increasing the volunteer involvement of science, mathematics, and technology professionals by 10%. Increase peer mentors (students) by 10% as well.

- Recognizing that curricula are often outdated, work directly with teachers and students to provide professional develop-



Dr. Hermann A. Grunder, Director, Continuous Electron Beam Accelerator Facility

ment opportunities as well as to update knowledge.

- Work cooperatively with the education community to plan programs in and out of schools.
- Mobilize scientists, mathematicians, and research personnel to become involved in schools.
- DOE labs can make major regional efforts.
- DOE can spearhead the development of a generic plan for outreach to be used by those who work as volunteers in other institutions.
- Mobilize members of the community-at-large to work in cooperation with science, mathematics, and educational communities and to establish networks for communication.
- Train volunteers of all ages from all sectors.

Actions/Projects - 7B

7.6 Identify focal points within communities for alliances among educational community and the community-at-large. Use existing alliances (such as the Triangle Coalition for Science and Technology) to help in this task. Some of these focal points could be:

- DOE facilities
- Other government agencies
- Other institutions (business and industry, professional associations).

7.7 Assess the needs of the local community through meetings.

- Identify needs.
- Determine goals that will meet needs.
- Identify existing local and regional programs and new ideas that will help meet these goals.

7.8 Determine mechanisms for addressing needs and reaching classroom teachers and others through both existing communications channels and by developing new ones.

7.9 Establish communication with local and State authorities: governor, mayor, school board, principals, teachers, business leaders, universities and colleges, and youth leaders.

7.10 Establish communication with parents and the PTA through meetings, lectures, churches, and other community groups.

7.11 Meet with science and math teachers. Articulate local and general issues, and emerge with a work plan. Determine what is effective (people, programs, institutions) and disseminate findings.

7.12 Meet with students to develop peer mentors in science and math.

7.13 Identify coordinator/champion of activities in institutions. Determine what resources are available: volunteers, materials, facilities.

7.14 Organize regional consortia which utilize all resources in the area: national labs, research centers, and industry.

7.15 Develop a regional science resource handbook by surveying teachers to determine what facilities and institutions are accessible and provide useful experiences. Identify specific personnel at each institution who are committed to maintaining accessibility and value.

7.16 Establish a cooperative program with engineers who build equipment for classroom experiences, and teachers who test and develop curricula for the equipment. The equipment and materials can then be shared with other schools.

7.17 Scientific institutions and industry can provide facilities on weekends to teachers, students, and the public for training, mentoring, and other activities.

7.18 Train and educate scientists and technical staff so they can transfer their skills and experience to teachers and students. Volunteers should be under the direction of teachers, who know what is needed and how it can be incorporated into the classroom experience.

7.19 Teachers need release time and freedom to participate in science and math education activities. In-service training is needed for teachers as well. Incentives must be provided to motivate teachers to invest the time and energy participation requires.

7.20 Science and mathematics professionals need incentives too, such as recognition at the local, regional, and national levels.

7.21 Parents need to be involved so they can provide the support and encouragement needed by the students.

7.22 Family members (parents, grandparents, siblings) can be trained to augment teachers' resources, especially at the elementary school level.

7.23 Develop a database covering science and mathematics education resources throughout the Nation. Establish an 800 telephone number to provide regional resource information to teachers, students, and parents.

7.24 Target the private sector as well as agencies to take responsibility for each of the 16,000 school districts so that each will have a community support group.

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SUNDAY, OCTOBER 8, 1989

6:30 PM 7:30	RECEPTION and DINNER		University Art Museum University of California, Berkeley
		Master of Ceremonies	Glenn T. Seaborg Chairman, Lawrence Hall of Science Former Chancellor University of California, Berkeley
			Charles V. Shank Director Lawrence Berkeley Laboratory
			James D. Watkins Admiral, U.S. Navy (Retired) Secretary of Energy
			Richard H. Truly Vice Admiral, U.S. Navy (Retired) Administrator National Aeronautics and Space Administration
		Keynote	F. James Rutherford Chief Education Officer and Director, *Project 2061*, American Association for the Advancement of Science
9:00		Closing Remarks	Glenn T. Seaborg

MONDAY, OCTOBER 9, 1989

9:00 AM PLENARY SESSION — Auditorium, Lawrence Hall of Science

Charles V. Shank, Moderator

Welcome — Marjorie Gardner, Director, Lawrence Hall of Science

Speakers — David P. Gardner, President, University of California

Richard H. Truly, Vice Admiral, U.S. Navy (Retired), Administrator, NASA

Glenn T. Seaborg, Chairman, Lawrence Hall of Science

Charles E. M. Kolb, Deputy Under Secretary for Planning, Budget & Evalutation, U.S. Department of Education

James D. Watkins, Admiral, U.S. Navy (Retired), Secretary of Energy

10:30 PRESS CONFERENCE — Amphitheater

11:00 PLENARY SESSION — Auditorium, Lawrence Hall of Science

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Albert Shanker, President, American Federation of Teachers

Bill Honig, Superintendent of Public Instruction and Education Director, State of California

11:30 Presentation – Chicago Education Reform Partnerships

Leon Lederman, Director Emeritus, Fermi National Accelerator Laboratory, Governor's Science Advisor, State of Illinois

Lourdes Monteagudo, Deputy Mayor for Education, City of Chicago

12:00 PM	General Discussion on Working Group Projects	
		Leon Lederman, Moderator
12:20	Concluding Remarks, Charge to Working Groups	
		Secretary Watkins
12:30	LUNCH	Pauley Hall A Level, Lawrence Hall of Science
	Introduction	Secretary Watkins
	The Chicago Science Explorers Project	
		Alan Schriesheim Director Argonne National Laboratory
		Bill Kurtis Producer
2:00	WORKING GROUP SESSIONS	Lawrence Hall of Science
7:30	DINNER	Empire Ballroom Claremont Hotel
	Host	Secretary Watkins
	Entertainment	Albany High School Concert Choir
	Speakers	Frederick S. Humphries President Florida A&M University
		Barbara Morgan Teacher in Space Designee NASA
	Reports	Working Group Chairmen
9:30	Closing Remarks	Secretary Watkins

TUESDAY, OCTOBER 10

9:00	WORKING GROUP SESSIONS	Lawrence Hall of Science
12:00 PM	LUNCH	Patio Lawrence Hall of Science
	Introduction	Glenn T. Seaborg
	Speakers	The Honorable George E. Brown, Jr. Member of Congress
		W.J. Price President Chevron U.S.A. Inc.
1:30	PLENARY SESSION - WORKING GROUP FINAL REPORT	
		Auditorium Lawrence Hall of Science
		Marjorie Gardner, Moderator
4:00	RESOLUTIONS AND CONFERENCE SUMMARY	
		Secretary Watkins Glenn T. Seaborg
5:00	CONCLUDING RECEPTION	Lawrence Hall of Science

MATH/SCIENCE EDUCATION ACTION CONFERENCE

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